NAVAL POSTGRADUATE SCHOOL
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THESIS

AN INVESTIGATION INTO THE LEVEL OF COMPENSATION IN THE AEROSPACE INDUSTRY

by

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June 1983

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This thesis makes extensive use of archival data in the public sector to ascertain and compare the level of wages and compensation among industries, concentrating on the aerospace industry in particular. The segments which comprise the industry are analyzed extensively and trends noted and discussed. A review of factors found by the Bureau of Labor Statistics to influence pay in domestic manufacturing is

(20. ABSTRACT Continued)

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An Investigation into the Level of Compensation in the Aerospace Industry

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ABSTRACT

This thesis makes extensive use of archival data in the public sector to ascertain and compare the level of wages and compensation among industries, concentrating on the aerospace industry in particular. The segments which comprise the industry are analyzed extensively and trends noted and discussed. A review of factors found by the Bureau of Labor Statistics to influence pay in domestic manufacturing is included and the applicability of these factors to the aerospace industry is examined where possible. Some theoretical concepts of wages are discussed in order to provide a perspective from which to review the findings of fact and to provide a most useful construct with which to pursue further investigation.

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I. INTRODUCTION

Department of Defense (DOD) expenditures in the aerospace industry remain at high levels and in the forefront of public debate on the defense budget. As aerospace has often been defined as a highly competitive industry which consumes a large portion of this country's technological and skilled labor resources, it follows that the level of wages in aerospace should be a topic of prime concern in DOD. Recently DOD has initiated a number of studies of compensation in the aerospace industry. The purpose of this thesis is to attempt to ascertain that level and to compare the aerospace industry with other industries.

In Chapter II, the composition of the industry will be explored and the various classification schemes used for analysis, described. The magnitude of DOD outlays in aerospace will be identified. Profitability and employment will be discussed for all manufacturing industries and the aerospace industry, in particular. Chapter III will explore, in depth, the wages of production workers in aerospace. Comparisons will be made with other industries and the movement of wages within the individual segments of the aerospace industry will be analyzed and anomalies identified and discussed. Chapter IV is a discussion of three variables (occupation, area, and industry) that the Bureau of Labor

Statistics has found to influence the structure of pay in domestic manufacturing. Some comparisons are drawn with the aerospace industry. Chapter V discusses some theoretical concepts of wages which form the basis for any extensive analysis of wage structure and which suggest a construct useful in further analysis. Conclusions are presented in Chapter VI.

II. THE AEROSPACE INDUSTRY

A. INDUSTRY COMPOSITION AND CLASSIFICATION

The aerospace industry is composed of companies engaged in the research, development and manufacture of aerospace systems. The Aerospace Industries Association of America (AIA) includes in its definition

> ...manned and unmanned aircraft; missiles, space launch vehicles and spacecraft; propulsion, guidance and control units for all of the foregoing; and a variety of airborne and ground based equipment essential to the test, operation, and maintenance of flight vehicles. [Ref. 1].

Robert S. Tiemann, writing on aerospace manufacturing [Ref. 2] notes that "no other field employs such diversified talents". Some companies choose to operate as prime contractors for an entire system, while others tend to specialize in particular sub-systems or components. This stratification of firms throughout the industry presents problems for the observer who may be interested in firms participating in a particular segment.

The Standard Industrial Classification (SIC) Manual[1] was originally prepared by the Office of Management and Budget for the purpose of promoting the comparability of

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[1]Since 1977 the responsibility for maintenance of both the SIC and the Enterprise SIC (ESIC) manuals were assumed by the Dept. of Commerce, Office of Federal Statistical Policy and Standards.

statistics. SIC codes are defined to provide the information necessary to classify individual establishments by product lines. The classification scheme used is important when analyzing statistics from a variety of sources, including both public and private sources. Table I shows the classifications used to describe the major aerospace firms (Aircraft, Missiles and Space Vehicles) involved with government procurement. Standard and Poor's [Ref. 3] lists 46 firms under SIC 3721, 115 under SIC 3724 and nearly 250 under SIC 3728. Here firms are commonly listed under more than one product line. In order to define the aerospace industry completely in terms of SIC codes it would be necessary to add to those classifications in Table I a number of other industries, such as aeronautical instruments, included in SIC 3811, and aeronautical electrical equipment in SIC 3694.

The Federal Trade Commission (FTC) in its Quarterly Financial Reports (QFR) program uses the Enterprise Standard Industrial Classification (ESIC) Manual, 1974. The ESIC Manual was also promulgated by the Office of Management and Budget. The manual states that the classification was developed to provide a standard for use with statistics about enterprises by kind of economic activity. The enterprise unit includes all unconsolidated subsidiaries more than 50 percent owned by parent corporations. The difference between the SIC and ESIC systems is that the former provides for separation of individual establishments by product lines

TABLE I

Standard Industrial Classification (SIC)

Major Group:	37	- Transportation Equipment
Group:	371	- Motor Vehicles and Motor Vehicle Equipment
	*372	- Aircraft and Parts
Industry:		3721 - Aircraft (establishments primarily engaged in manufacturing or assembling complete aircraft)
		3724 - Aircraft Engine and Parts
		3728 - Aircraft Engine and Parts, nec.
	373	- Ship and Boat Building and Repairing
	374	- Railroad Equipment
	375	- Motorcycles, Bicycles and Parts
	*376	- Guided Missiles and Space Vehicles and Parts
		3761 - Guided Missile and Space Vehicles (establishment primarily engaged in manufacturing complete guided missiles and space vehicles)
		3764 - Guided Missile and Space Vehicle Propulsion Units and Propulsion Unit Parts
		3769 - Guided Missile and Space Vehicle Parts and Auxiliary Equipment, nec.
	379	- Miscellaneous Transportation

Source: Standard Industrial Classification Manual 1972 [Ref. 4].

* : Four digit code shown for aerospace industry only.

nec. : Not elsewhere classified.

and the latter separates companies by type of economic activity. The latter distinction is more useful for the previously mentioned QFR program conducted by the FTC, which uses financial data prepared in accordance with generally accepted accounting principles.

Table II provides a listing of the ESIC codes formulated to describe the aerospace industry in terms of economic activity. It is of interest to note that under the ESIC system it is not possible to separate the aircraft and guided missile segments of the industry.

Compounding the comparability of statistics from different sources is the proliferation of private data bases and classification schemes. Standard and Poor's, in its surveys of the aerospace industry classifies major aerospace companies for the purpose of presenting comparative company analyses into five major groups: Diversified, subcontractors and systems, airframe, propulsion and engines, and general aviation.

B. AEROSPACE AND NATIONAL DEFENSE

Government spending for aerospace products and services continues to represent a significant proportion of the total national defense budget. Table III shows Department of Defense (DOD) outlays in the aerospace industry averaging 13.3 percent of the total federal outlay for national defense from 1975 to 1978, and 10.7 percent for the period 1979 through 1983. Despite this overall decline, the latter period shows a steady

TABLE II

Enterprise Standard Industrial Classification (ESIC)

ESIC Code		Corresponding SIC Code(s)
37	Transportation Equipment	37
37.1	Motor Vehicles and Equipment	371
37.10	Motor Vehicles and Equipment	3711-6
37.3	Ship and Boat Building and Equipment	373
37.30	Ship and Boat Building and Equipment	3731,2
37.7	Aircraft, Guided Missiles and Parts	372,6
37.71	Aircraft and Guided Missiles	3721,61
37.79	Aircraft and Guided Missiles Parts	3724,8,64,9
37.9	Transportation Equipment, nec.	374,5,9
37.90	Transportation Equipment, nec.	3743,51,92-9

Source: Enterprise Standard Industrial Classification Manual 1974 [Ref. 5].

TABLE III

Federal Outlays for Defense, Aerospace Products and Services, and Aircraft Procurement

(1975-1983)

(millions)

Year	Total National Defense	DOD Outlay for Aerospace Products and Services	Aerospace as percent of Natl. Defense	DOD Outlays for Aircraft Procurement	Aircraft Procurement as percent of DOD Outlays for Aerospace
1975	85,552	12,762	14.9	7,697	60.3
1976	89,430	13,295	14.9	8,704	65.5
Tr. Qtr.	22,307	3,018	13.5	2,096	69.4
1977	97,501	14,361	14.7	9,321	64.9
1978	105,186	8,765	8.3	6,971	79.5
1979	117,681	10,920	9.3	8,836	80.9
1980	135,856	13,585	10.0	11,124	81.9
1981	159,765	16,706	10.5	13,193	79.0
1982[E]	187,497	20,204	10.8	15,767	78.0
1983[E]	221,068	28,008	12.7	21,746	77.6

E - estimate

Source: AIA, Aerospace Facts and Figures 1982/3; percentage derived [Ref. 7].

Note: Prior to 1978, DOD outlays for aircraft and missile procurement and RDT&E; Effective 1978, includes only procurement outlays for RDT&E by product groups not available.

increase from a low of 8.3 percent in 1979 to 10.5 percent in 1981 and a projected 12.7 percent share in 1983. In contrast, DOD outlays for aircraft procurement as a percent of total DOD aerospace expenditures have not shown a similar decline. Aircraft procurement rose from an average of 67.9 percent of aerospace expenditures from 1975 to 1978 to 79.5 percent in the period 1979 through 1983.

In general, military hardware sales are expected to lead aerospace sales through 1983 [Ref. 6]. Military aircraft sales increased 19 percent in 1981 to $19 billion and 18 percent to $22.8 billion in 1982 and is forecasted to rise another 12 percent in 1983.[2] This is in contract to an overall decrease in aerospace industry sales of 0.3 percent in 1983 after an increase of 39 percent in 1981.

Table IV lists the top ten DOD major contractors as ranked by the AIA for fiscal year 1981. The ranking was based on the net value of prime contracts awarded during the last fiscal year. Of particular interest at this point is the fact that seven of the top ten defense contractors have at least one major aircraft under contract. These same aircraft prime contractors were included in the top ten throughout the period of 1977-1981.

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[2]The term sales includes DOD outlays for aircraft RDT&E and net sales to other than U.S. Government.

TABLE IV

Department of Defense Major Contractors

(millions)

Top Ten (1981 Ranking by AIA)	1981 Net Value of Prime Contracts Awarded During Last Fiscal Year	Major Aircraft (Prime Contractor) Association
McDonnel Douglas Corp.	4,409	F-15, KC-10, F-18, AV8-B
United Technologies Corp.	3,776	UH-60A, SH-60B (F-15,16 Engines)
General Dynamics Corp.	3,402	F-16
General Electric Corp.	3,018	
Boeing Co.	2,683	AWACS
Lockheed Corp.	2,657	C-5
Hughes Aircraft Corp.	2,552	AH-64
Raytheon Co.	1,826	
Grumman Corp.	1,710	F-14
Chrysler Corp.	1,410	
Total All Contracts	97,389	

Source: AIA, Aerospace Facts and Figures 1982/3 [Ref. 8]. Standard and Poor's, "Aerospace Current Analysis" [Ref. 9].

C. PROFITABILITY

The aerospace industry continues to present high barriers to entry in terms of high capital investment. This is especially true in the case of prime contracts for major military aircraft. The capital required to launch a new program has been described as colossal.

> More than any other industry, aerospace combines the challenges of high technology research and engineering with those of heavy-equipment manufacturing.... The industry is both capital and labor intensive. On average, labor costs comprise about 35 percent of revenues... [Ref. 10]

Capital expenditures for the industry have exceeded 10 percent of revenues in recent years. This would be about double net income. Expenditures for research and development constitute about 20 percent of industry sales.

Table V provides a review of three indicators of profitability. Net profit after taxes is expressed as a percentage of sales, assets and equity. The rates of return were obtained from data compiled by the Federal Trade Commission. The figures for the aerospace industry conform to the ESIC classification 37.7; aircraft, guided missiles and parts (see Table II). As such, the figures are representative of the industry as a whole; and it is not possible to separate segment (i.e., aircraft only) data from the remainder of the industry.

The figures show aerospace traditionally lagging behind the average for all manufacturing corporations in returns

TABLE V

Aerospace Industry / All Manufacturing
Rates of Return: Net Profit (After Taxes) as
a Percent of Sales, Assets, Equity 1977-1981

Year	All Manufacturing Corporation			Aerospace Industry (ESIC) 37.7		
	Sales	Assets	Equity	Sales	Assets	Equity
1981	4.8	6.7	14.0	4.3	5.0	17.3
1980	4.8	6.9	13.8	4.3	5.2	16.0
1979	5.7	8.4	16.5	5.0	6.3	18.4
1978	5.4	7.8	15.0	4.4	5.5	15.7
1977	5.3	7.6	14.2	4.2	5.7	14.9

Source: Federal Trade Commission [Ref. 12].

on net sales revenue and total assets. However, return on stockholders' equity or net assets have been running about two percentage points higher than manufacturing in general. This difference suggests the greater use of debt to finance operations in the industry. Although the industry would prefer a larger proportion of commercial business, which generates a higher profit margin than the 3 to 4 percent average earned on government sales [Ref. 11], the airline industry is slack as the military market continues upward. This will continue to depress profit margins in the industry.

Even as the military market continues to expand, pressures become greater to hold costs down. Greater emphasis on multi-year contracting is one way to decrease costs per unit. Another area of current DOD interest is labor costs. With labor costs at 35 percent of revenues for the aerospace industry, it is indeed a major factor.

D. EMPLOYMENT IN GENERAL

The Bureau of Labor Statistics (BLS) reports that, although there was increased demand for almost all types of goods, employment growth in manufacturing over the decade of the seventies was limited to 5 percent, less than in any other sector except agriculture. The projection for manufacturing in the next decade is a growth range of 15 to 25 percent. Employment in durable goods is expected to advance 19 to 30 percent, while in nondurable goods manufacturing

it is expected to advance more slowly, 8 to 15 percent [Ref. 13]. The reason for the large range in BLS projections[3] is the Bureau's presentation of data from two scenarios. The first scenario assumes decline in the rate of labor force growth, continued high inflation, moderately high unemployment, and modest increases in production and productivity. The high trend projection assumes a slowdown in inflation and unemployment rates [Ref. 14].

Tiemann notes that, particularly in the aerospace industry, demand for skilled professionals continues to grow. He observed that in the space program there has always been a high ratio of skilled to unskilled labor and that over the last decade this ratio has increased [Ref. 15]. Additionally, the Secretary of the Air Force has discussed a shortfall in the supply of trained production workers. He stated that

> ...the labor supply shortfall, along with high salaries, has forced the price of the McDonnell Douglas F15 100 times higher than the Lockheed P-38 while the cost of a college education has only doubled since 1950. [Ref. 16]

The same article referred to an AIA study which found the shortage most acute in the areas of optics, metallurgy and machine tool operation.

Although the outlook for the future is for continued growth, the first two years into the decade of the 1980's continue to show a decline in total nonagricultural employment.

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[3]Projections prepared prior to April, 1982.

This decline in employment is mirrored in the aircraft and parts industry, SIC 372. Table VI shows total nonagricultural employment peaking in 1981 at 91.1 million and averaging 89.6 million in 1982. Manufacturing employment declined from a peak of 21 million in 1979 to 18.8 million in 1982. Employment in aircraft and parts, SIC 372, peaked in 1980 at 652,000 and has since declined to 612,000 in 1982. With the period 1980-1982 as a base for comparison, total employment is down 8.6 percent, manufacturing decreased by 7.1 percent and aircraft and parts, SIC 372, decreased by 6.2 percent. The aircraft industry, SIC 3721, alone declined in employment by 7 percent.

In sharp contrast to the overall decline in employment, one section of the aerospace industry continued to expand. The guided missiles, space vehicles and parts segment, SIC 376, advanced to an all-time high of 127,000 by 1982. This constitutes an increase in employment of 14.4 percent at a time when the aircraft and parts segment decreased by 6.2 percent.

Table VII provides a breakdown of production employees for the same period of time, 1977-1982. In 1979, the peak year for manufacturing employment, production employees accounted for 71.3 percent of total employment. By 1982 this percentage had declined to 67.8 percent. The aircraft and parts segment, SIC 372, has had a significantly smaller proportion of its employees classified as production--

TABLE VI

Average Annual Employment
All Employees 1977-1982

(thousands)

	(SIC)	1977	1978	1979	1980	1981	1982
Total Nonagricultural	N/A	82,471	86,697	89,823	90,406	91,105	89,630
Manufacturing	N/A	19,682	20,505	21,040	20,285	20,173	18,848
Aircraft and Parts	(372)	481.7	527.2	610.8	652.3	648.9	611.8
Aircraft	(3721)	270.4	288.3	333.2	349.3	345.8	325.0
Aircraft Engines and Parts	(3724)	120.9	133.5	151.6	162.9	163.3	151.4
Aircraft Equipment, nec.	(3728)	90.4	105.5	126.1	140.1	139.8	135.5
Guided Missiles, Space Vehicles and Parts	(376)	83.4	93.4	101.5	111.3	121.7	127.3
Guided Missiles and Space Vehicles	(3761)	65.5	74.6	80.8	87.8	95.3	100.7

Source: SIC code data through 1981 obtained from "Supplement to Employment and Earnings" [Ref. 17], other data from "Employment and Earnings" [Ref. 18].

TABLE VII

Average Annual Employment
Production Employees 1977-1982

(thousands)

	(SIC)	1977	1978	1979	1980	1981	1982
Manufacturing	N/A	14,066	14,610	15,010	14,227	14,083	12,782
Aircraft and Parts	(372)	246.8	275.4	332.1	354.6	344.6	309.9
Aircraft	(3721)	124.4	133.9	165.9	173.7	167.8	146.9
Aircraft Engines and Parts	(3724)	66.6	75.3	86.4	93.0	92.9	85.7
Aircraft Equipment, nec.	(3728)	55.8	66.2	79.8	88.0	83.9	77.3
Guided Missiles, Space Vehicles and Parts	(376)	26.4	29.0	32.5	35.0	36.5	39.0
Guided Missiles and Space Vehicles	(3761)	18.8	21.0	23.8	25.9	26.7	29.2

Source: SIC code data through 1981 obtained from "Supplement to Employment and Earnings" [Ref. 17], other data from "Employment and Earnings" [Ref. 18].

54.4 percent in 1980 and 50.6 percent in 1982. The guided missiles, space vehicles and parts segment, SIC 376, has an even greater number of nonproduction employees. In 1982 production employees accounted for only 30.1 percent in this segment, down slightly from previous years.

The sources used to extract the figures on aerospace employment were compiled by the Bureau of Labor Statistics. Only data which had a SIC code associated directly with an aerospace activity were included. As previously mentioned under the Standard Industrial Classification discussion, a substantial portion of aerospace-related production lies outside of the primary SIC classifications. The same can be said of employment data. A substantial number of employees whose primary output is in the aerospace area remain classified in other industries (primarily communication and electrical instruments). The AIA estimates that in 1981 approximately 36 percent of total aerospace employment is thus classified (150,000 in communications equipment and 280,000 in "other") [Ref. 19].

Much of the discussion thus far has focused on systems used to classify the aerospace industry. The data source selected, with its unique system of classification, brings to each discussion a different perspective and thus influences the analysis of published data. This awareness of the problems of scope and classification will be useful in the discussion of wages and compensation that follows in the next chapter.

III. AEROSPACE COMPENSATION

A. LABOR COST PERSPECTIVE

The last chapter discussed employment in general and in the aerospace industry. This chapter will be concerned with the cost of that employment. Labor costs will be explored for industry in general and specifically in the aerospace industry. The distinction between wages (payroll) and compensation is germane to this discussion and will be discussed in detail.

The concept of "labor costs" is fraught with many of the same problems related to definition and classification that were discovered in the treatment of employment. As discussed in the last chapter, Standard and Poor's stated that labor costs in the aerospace industry amounted to 35 percent of revenues. Two other estimates of this labor cost follow.

Table VIII was prepared from Aerospace Industries Association (AIA) estimates of aerospace industry total sales and annual payroll [Ref. 20]. It shows that annual payroll costs have averaged 51.6 percent of total sales in the five-year period 1977-1981.

TABLE VIII

Aerospace Payroll as a Percent of Industry Sales (1977-1981)

(millions)

	1977	1978	1979	1980	1981
Sales	$33,854	$38,939	$44,210	$52,896	$63,490
Annual Payroll	16,276	19,501	24,243	28,795	32,105
Payroll as Percent	48.1	50.1	54.8	54.4	50.6

The same AIA source also published similar data, gathered by the Bureau of Economic Analysis (BEA), for all manufacturing industries. Table IX presents these data for comparison. In the period 1977-1981 annual payroll averaged 19.5 percent of sales.

TABLE IX

Manufacturing Payroll as a Percent of Manufacturing Sales (1977-1981)

(billions)

	1977	1978	1979	1980	1981
Sales	$1,330.1	$1,496.6	$1,727.3	$1,845.9	$1,997.8
Annual Payroll	266.0	299.2	333.4	350.7	387.3
Payroll as Percent	20.0	20.0	19.3	19.0	19.4

It is not clear if the concept of labor cost as used by Standard and Poor's refers to direct labor or includes an allocation of indirect labor costs attributable to production.

Upon inspection, the figure quoted would appear intuitively too low to represent total expenditures for all employees. The term "payroll", as used in the preparation of Table VIII was estimated by the AIA "...on the basis of average weekly earnings...for production workers plus an estimated annual salary for other employees" [Ref. 21]. Based on this definition, it is most probable that, when fringe benefits (e.g., FICA, unemployment and workmen's compensation, plus contributions to supplemental benefits, such as retirement and health benefits) are added, the derived percentages would increase appreciably. The figures in Table IX were credited by AIA to the monthly Survey of Current Business prepared by the BEA. If the BEA's definition of payroll were to be specifically enumerated here, it is quite possible that the AIA's stated criteria could turn out to be sufficiently non-specific so as to preclude true comparability of the data.

Table X provides a breakdown of the aerospace payroll by production and other employees. From 1977 to 1981 the ratio of payroll attributable to production workers averaged 41 percent. This percentage had remained constant for the previous five-year period (1972-1976). It is down 4 percent from the preceding ten-year period (1962-1971) when the production workers' payroll share averaged 45 percent.

Figures on employment derived from Tables VI and VII for the period 1977-1981 indicate the following percentages for production worker employment by aerospace segments:

(1) Aircraft (SIC 3721) 48.1 percent.

(2) Aircraft engines (SIC 3724) 56.5 percent.

(3) Aircraft equipment (SIC 3728) 62.1 percent.

(4) Guided missiles and space vehicles (SIC 3761) 28.8 percent.

TABLE X

Aerospace Payroll Distribution
Production & Others (1977-1981)

(millions)

Year	Aerospace Total Payroll	Production Payroll	% of Totals	Other Payroll	% of Total
1977	$16,276	$ 6,464	39.7	$ 9,812	60.3
1978	19,501	7,873	40.4	11,628	59.6
1979	24,243	10,247	42.3	13,996	57.7
1980	28,795	12,087	42.0	16,708	58.0
1981	32,105	13,088	40.8	19,017	59.2

Source: AIA estimates [Ref. 22]

Thus, in contrast to the S & P estimate of labor costs as 35 percent of revenues, it can be seen that other data indicate payroll in the aerospace industry running at about 52 percent of sales in a period where manufacturing payroll averaged 20 percent of sales. Although the data in Table X indicate that, as an industry average, about 41 percent of the aerospace payroll was distributed to production employees, the employment of production workers by aerospace segments varies so widely (29 to 62 percent) that this average proves not to be applicable to any particular segment.

B. PRODUCTION WORKER HOURLY EARNINGS

Table XI provides a comparison of average hourly earnings by major industry division for the period 1977-1982. The data were compiled by the BLS for their Employment and Earnings series and cover production and related workers in manufacturing and mining, construction workers, and nonsupervisory workers in all other industries. The hourly earnings figure was computed from aggregate payroll data consisting of wages and salaries paid to employees before deductions. It includes payments for overtime, leave (including sick leave), and holidays. Excluded are bonuses, unless earned and paid each period, and fringe benefits. As can be seen from the data, the earnings vary considerably by industry. In 1982 the hourly earnings of the highest paying industry (construction) were 1.85 times those of wholesale and retail trade and 1.5 times those of the total private nonagricultural sector. Industries are listed according to earnings ranking. This ranking has been unchanged since 1978 and has been remarkably consistent over a period of twenty years.[4] One exception to this order is the passing of the transportation and public utilities category by mining. Transportation had occupied the number 2 position ahead of mining since transportation's inclusion in 1964. Starting in 1975 the two industries swapped back and forth until 1978, when mining became firmly established

[4]The original data covered the period 1962-1982.

TABLE XI

Average Hourly Earnings,
Nonagricultural Production or Nonsupervisory Workers
by Industry Division 1977-1982

(current dollars)

	1977	1978	1979	1980	1981	1982
Construction	8.10	8.66	9.27	9.94	10.80	11.56
Mining	6.94	7.67	8.49	9.17	10.05	10.82
Transportation and Public Utilities	6.99	7.57	8.16	8.87	9.70	10.31
Manufacturing	5.68	6.17	6.70	7.27	7.99	8.50
Services	4.65	4.99	5.36	5.85	6.41	6.91
Finance, Insurance and Real Estate	4.54	4.89	5.27	5.79	6.31	6.78
Wholesale and Retail Trade	4.28	4.67	5.06	5.48	5.93	6.22
Total Private	5.25	5.69	6.16	6.66	7.25	7.67

Source: 77-81 from "Supplement to Employment and Earnings", Bureau of Labor Statistics, June 1982; 1982 data from "Employment and Earnings", monthly [Ref. 17 & 18].

in the number 2 position. Additionally, the services industry was included in 1964 and occupied last place. In 1965 it moved up one position to number 6 and remained there until 1976. In 1976 services became firmly entrenched in the number 5 position ahead of finance and trade.

Table XII indexes the hourly earnings data originally presented in Table XI (1977 = 100). Examination reveals at least one anomaly in the data. Construction, traditionally ranked as number 1 in average hourly earnings, has for the period presented ranked last in terms of improvement on its 1977 earnings position. A partial explanation could lie in the heavy toll that inflation took in the construction industry in this period. In 1982 its index stood at 142.7. By contrast, mining, the number 2 ranking industry, has consistently ranked first in terms of improvement on its 1977 wage. Its 1982 index stands at 155.9 and its hourly earnings at 94 percent of construction instead of 86 percent in 1977. If this trend continues, mining could be expected to surpass construction as the highest paying industry (ranked by production worker hourly earnings).

In Table XIII the average hourly earnings for segments of the aerospace industry for which BLS data are available are listed. The period covered is the same as the major industry data (1977-1982). The obvious comparison lies in the magnitude of the difference between the hourly earnings of the aerospace industry and its major industry classification--

TABLE XII

Index of Average Hourly Earnings
Production or Nonsupervisory Workers, by Industry Division
1977-1982 (1977 = 100)

	1977	1978	1979	1980	1981	1982
Construction	100.0	106.9	114.4	122.7	133.3	142.7
Mining	100.0	110.5	122.3	132.1	144.8	155.9
Transportation and Public Utilities	100.0	108.3	116.7	127.9	138.8	147.5
Manufacturing	100.0	108.6	118.0	128.0	140.7	149.6
Services	100.0	107.3	115.3	125.8	137.8	148.6
Finance, Insurance and Real Estate	100.0	107.7	116.1	127.5	139.0	149.3
Wholesale and Retail Trade	100.0	109.1	118.2	128.0	138.6	145.3

Source: Table XI

TABLE XIII

Average Hourly Earnings,
Aerospace Industry, Production Employees 1977-1982

(current dollars)

	SIC	1977	1978	1979	1980	1981	1982
Aircraft and Parts	372	6.92	7.54	8.26	9.28	10.31	11.25
Aircraft	3721	7.07	7.70	8.50	9.66	10.74	11.85
Aircraft Engines and Engine Parts	3724	7.05	7.80	8.53	9.42	10.41	11.16
Aircraft Equipment, nec.	3728	6.44	6.93	7.48	8.40	9.38	10.26
Guided Missiles, Space Vehicles and Parts	376	7.04	7.56	8.25	9.22	10.06	10.96
Guided Missiles and Space Vehicles	3761	7.15	7.72	8.38	9.33	10.34	11.21
All Manufacturing	N/A	5.68	6.17	6.70	7.27	7.99	8.50

Source: 77-81 data from "Supplement to Employment and Earnings", Bureau of Labor Statistics, June 1982; 1982 from "Employment and Earnings", monthly [Ref. 17 & 18].

manufacturing. In 1982 the aircraft segment (SIC 3721) earnings figure was 1.4 times that of manufacturing and exceeded the highest paying industry division (construction) by 2.5 percent. The lowest aerospace segment, aircraft equipment (SIC 3728), exceeded the manufacturing average by 20.7 percent in 1982, up from 13.4 percent in 1977. If aircraft equipment were to be treated as a separate sector it would rank in the number 4 position ahead of manufacturing for the period 1977-1982. The remaining aerospace segments would all qualify in the number 2 position for the same period, except for 1982, when aircraft would rank as the number 1 industry. In addition, as the aircraft equipment segment continues to pull away from manufacturing, it has drawn about even with the third ranked industry, transportation and public utilities. In 1977 the aircraft equipment segment hourly earning figure stood at 92.1 percent of transportation. By 1982 this ratio was 99.5 percent.

The relationship among three out of four of the aerospace segments has been anything but static in the period presented. The aircraft, engines and missiles segments (SIC 3721, 3724, 3761) have all occupied the top 3 positions. In contrast, the equipment segment has consistently occupied last place. Table XIV provides a ranking of these aerospace segments. There has been a succession of dominant segments in the industry in the period 1977-1982. Guided missiles and space vehicles led in 1977. Aircraft engines moved ahead

in 1978, while missiles dropped to second place. Engines still led in 1979 but missiles dropped to third. In the last three years, 1980-1982, aircraft moved decidedly into the top position.

TABLE XIV

Ranking of Aerospace Segments by Average Hourly Earnings (1977-1982)

	SIC	1977	1978	1979	1980	1981	1982
Aircraft	3721	2	3	2	1	1	1
Aircraft Engines	3724	3	1	1	2	2	3
Aircraft Equipment	3728	4	4	4	4	4	4
Missiles and Space	3761	1	2	3	3	3	2

Source: Table XIII

If one considers the net difference in current hourly earnings among the segments, then a more consistent pattern develops. The picture presented is one in which the aircraft segment continues to pull away from the other segments, while the positions of the remaining segments relative to each other appear to have stabilized somewhat. Table XV presents a series of three such comparisons. In the first comparison aircraft can be seen clearly to be pulling away from the other segments after overcoming slight leads by missiles in 1977 and 1978 and by engines in 1978 and 1979. The second and third comparisons show a general stabilization in the later years, with the possible exception of aircraft engines

TABLE XV

Net Difference in Average
Hourly Earnings of Aerospace Segments

(current dollars)

	SIC	1977	1978	1979	1980	1981	1982
Aircraft	3721						
Minus:							
Engines	3724	.02	-.10	-.03	.24	.33	.69
Equipment	3728	.63	.77	1.02	1.26	1.36	1.59
Missiles	3761	-.08	-.02	.12	.33	.40	.64
Aircraft Engines	3724						
Minus:							
Equipment	3728	.61	.87	1.05	1.02	1.03	.90
Missiles	3761	-.10	.08	.15	.09	.07	-.05
Aircraft Equip.	3728						
Minus:							
Missiles	3761	-.71	-.79	-.90	-.93	-.96	-.95

Source: Table XIII

in relation to missiles. These two segments remain highly competitive. The emergence of the aircraft segment to a position of dominance in recent years parallels closely the increasing share of DOD aerospace expenditures that the aircraft segment enjoys. Thus, the influence of the current market structure on wages cannot be ignored. This tendency for the wages of production workers in aircraft to act apart from the other aerospace sectors can be further implied from indexing average hourly earnings.

The 1982 index of average hourly earnings presented for the aerospace segments (Table XVI) shows aircraft at 167.6. The other segments range from 157 to 159. The position of leadership which the aircraft segment held in 1982, coupled with the grouping of the other segments substantially behind it would seem to indicate a secure position of leadership in hourly earnings in the next few years.

C. COMPENSATION DATA

The BLS states in its Handbook of Labor Statistics that

> the first studies of employer expenditures for employee compensation were undertaken in 1959 and related to selected industries. Beginning in 1966, the program was expanded to cover all private nonfarm industries [Ref. 23].

Unfortunately the series ends in 1977 when the program was discontinued. The data were highly aggregated as to industry (manufacturing vs. nonmanufacturing) and occupation (office vs. nonoffice workers). At the same time they were highly specific, in that compensation was presented in percentages

TABLE XVI

Index of
Average Hourly Earnings
Production Employees Aerospace Industry
1977-1982 (1977 = 100)

	SIC	1977	1978	1979	1980	1981	1982
Aircraft	3721	100.0	108.9	120.2	136.6	151.9	167.6
Aircraft Engines and Engine Parts	3724	100.0	110.6	121.0	133.6	147.7	158.3
Aircraft Equipment, nec.	3728	100.0	107.6	116.1	130.4	145.7	159.3
Guided Missiles and Space Vehicles	3761	100.0	108.0	117.2	130.5	144.6	156.8
All Manufacturing	N/A	100.0	108.6	118.0	128.0	140.7	149.6

Source: Table XIII

by the following functional groups: pay for time worked, pay for leave time (except sick leave), retirement, health and life insurance, unemployment benefits, and nonproduction bonuses and savings and thrift plans.

Table XVII presents BLS estimates of the percentages of compensation attributable to employer expenditures for supplements to wages and salaries. The definition of wages and salaries employed by the BLS in this series is analogous to the concept of gross payroll used to derive the average hourly earnings presented in Tables XI and XIII. Table XVII then represents a true complement to the hourly earnings data. Therefore, the 1977 hourly earnings of $5.68 for production workers in manufacturing could be said to represent 82.4 percent of total hourly compensation (supplements = 17.6 percent). Hence, a figure of $6.89 for average hourly compensation is arrived at. Such comparisons remain extremely limited due to the lack of industry specific data and cancellation of the BLS series.

Statistics compiled by the Bureau of the Census (BTC) in its Annual Survey of Manufactures [Ref. 24] also allow for computation of an estimate for the complement to wages and salaries in order to complete the total compensation picture. Compensation data are presented in the following categories: total, payroll, social security and other legally required payments, employer payments and other programs. The BTC data are aggregated for all employees, although they

TABLE XVII

Supplements to Wages and Salaries as a Percent of Total Compensation for Private Nonagricultural Workers Selected Years 1966-1977

	1966	1968	1970	1972	1974	1976	1977
All Workers	10.1	10.3	11.0	12.2	13.7	15.3	15.5
Manufacturing Industries:							
Production and Related Workers	11.2	11.6	12.6	14.1	15.6	16.9	17.6
Office Workers	9.9	10.5	10.9	12.3	14.2	15.9	16.6

Source: BLS, Handbook of Labor Statistics [Ref. 23].

provide for specification at the four digit SIC code level. The BLS published the following note on comparability of its payroll employment data with BTC statistics on manufacture and business:

> BLS establishment statistics on employment differ from employment counts derived by the BTC from its censuses or annual sample survey of manufacturing establishments and the censuses of business establishments [Ref. 25].

In the same reference the BLS explains that, in addition to the scope of the industries covered, the major reasons for non-compatibility are different treatment of business units considered parts of an establishment, such as central administrative offices and administration units, the industrial classification of establishments, and different reporting patterns by multiunit companies.

Table XVIII presents an estimate of supplements to wages and salaries derived from the BTC data. The data available for this discussion were limited in period covered and only the years 1977-1980 are presented. The figure for 1977 stands at 20.7 percent for all employees in manufacturing. The BLS figure for production employees in manufacturing was 17.6 percent. Of particular interest is that all aerospace segments rank below the average for all manufacturing (22.2 percent) in 1980. This has generally been the pattern for the four years covered. The only exception has been the aircraft segment, whose 1977 supplements of 22.8 percent stood 2.1 percent higher than the manufacturing average.

TABLE XVIII

Supplements to Wages and Salaries as a Percent of Total Compensation 1977-1980 Aerospace Employees

	SIC	1977	1978	1979	1980
All Manufacturing	N/A	20.7	21.2	21.7	22.2
Aircraft	3721	22.8	22.9	20.3	19.6
Aircraft Engines and Parts	3724	20.3	19.8	19.3	20.0
Aircraft Equipment, nec.	3728	18.6	19.3	18.8	18.8
Guided Missiles and Space Vehicles	3761	19.7	19.7	20.5	21.2

Source: Derived from 1978 and 1980 Annual Survey of Manufactures [Ref. 24].

By 1980 the aircraft figure had declined to 19.6 percent, 2.6 percent below the manufacturing average.

As noted above, the available BTC data on supplements to wages and salaries are extremely limited in scope. However, in the interest of maintaining a perspective on the compensation position of the aircraft industry (SIC 3721), a limited comparison is offered in Table XIX. The three industries cited are included in SIC 37, transportation equipment. It was established above that the supplements percentage in the aircraft sector is slightly below manufacturing in general and varies insignificantly among all segments of the aerospace industry. The total supplements figure for at least one other industry (ship building), which enjoys substantial DOD expenditures, is equivalent. Both industries differ markedly from motor vehicles in both basic hourly wages and supplemental payments. In that the compensation figures for motor vehicles relate directly to DOD purchases of troop vehicles, tanks and other transportation equipment, one might conclude that payment for production worker labor in the aircraft sector constitutes a bargain.

D. GENERAL COMPENSATION TREND INDICATORS

The Consumer Price Index (CPI) measures changes in prices for only a very specific market basket of goods. This fact had led to much discussion of the appropriateness of using the CPI as a benchmark in wage comparisons. All arguments

TABLE XIX

Selected Transportation Equipment Segments

	Aircraft SIC 3721	Motor Vehicles and Car Bodies SIC 3711	Ship Building and Repairing SIC 3731
1980 Average Hourly Earnings of Production Workers	9.66	10.80	8.56
1980 BTC Supplements to Wages and Salaries as a Percent of Compensation, All Employees			
Total	19.6	29.3	19.5
Legally Required (FICA, etc.)	6.1	6.6	9.7
Employer Payments (Fringe Benefits)	13.5	22.7	9.8

Source: [Ref. 17 & 24]

notwithstanding, the fact remains that many collective bargaining agreements contain Cost of Living Allowance (COLA) clauses based on the CPI. If one subscribes to the subsistence theory of wage determination, wherein the price of labor rises and falls in response to the price of food and necessities, then the use of the CPI for wage determination has some theoretical validity.

The BLS has since 1978 published two indexes. They are presented in Table XX. The newer CPI for All Urban Consumers (CPI-U) covers 80 percent of the noninstitutional population. The revised CPI for Urban Wage Earners and Clerical Workers (CPI-W) covers about 40 percent of the noninstitutional population and does not include professional, managerial and technical workers, the self-employed, short-term workers, the unemployed, retirees and others not in the labor force [Ref. 26]. The indexes differ little in percentage change in the period presented. From 1977-1982 the CPI-U increased 59.3 percent and the CPI-W increased 59 percent. The index of hourly earnings in Table XVI shows the aircraft segment increasing 67.6 percent in the same period. The increase in the remaining aerospace segments ranged from 56.8 to 59.3 percent.

Table XXI contains two indexes published by the BLS. They are derived from data compiled by both the BLS and the Bureau of Economic Analysis (BEA). The index of Compensation per Hour includes wages and salaries of employees plus

employers' contributions for social insurance and private benefit plans. In the period 1977-1982 this index for manufacturing increased by 58.8 percent. The index of Unit Labor Cost measures the labor compensation cost required to produce one unit of output and is derived by dividing compensation by output. The unit labor cost index increased 53.5 percent for manufacturing in the period 1977-1982. When compared with the previous index, this would indicate that a general increase in production or efficiency has accompanied rising compensation costs in manufacturing.

TABLE XX

Consumer Price Indexes, U. S. City
Annual Average 1977-1982 (1967 = 100)

	1977	1978	1979	1980	1981	1982
CPI-W	181.5	195.3	217.7	247.0	272.3	288.6
CPI-U	181.5	195.4	217.4	246.8	272.4	289.1

Source: Monthly Labor Review [Ref. 26]

The BLS also publishes an Employment Cost Index (ECI). It is a quarterly measure of the average change in the cost of employing labor. It is based on a sample of 2,000 private nonfarm establishments and 750 state and local government units. The 1970 Census data are used to fix employment so that changes in compensation can be computed. The series is available for total compensation and wages and salaries only. The definition of wages and salaries differs slightly

TABLE XXI

Indexes of Hourly
Compensation and Unit Labor Costs
1977-1982 (1977 = 100)

	1978	1979	1980	1981	1982
Nonagricultural Business Sector:					
Compensation Per Hour	108.6	118.8	130.9	143.6	154.0$_P$
Unit Labor Cost	108.0	119.6	133.0	143.8	153.9$_P$
Manufacturing:					
Compensation Per Hour	108.3	118.9	132.8	146.4	158.8$_P$
Unit Labor Cost	107.4	117.1	130.6	140.0	153.5$_P$

P = Preliminary

Source: Monthly Labor Review [Ref. 26].

from that used in computing the earlier hourly earnings data in that the ECI excludes pay for overtime, work on weekends and holidays and shift differentials [Ref. 26]. Table XXII presents selected ECI statistics. The series provides no SIC code data, but allows for a macro perspective on labor costs. In addition union vs. nonunion workers can be contrasted, and white- and blue-collar workers are divided into four general occupational areas.

E. SUMMARY

In developing a perspective on labor costs in the aerospace industry, we have seen that payroll costs for the industry as a whole averaged about 52 percent of sales in a period when manufacturing in general averaged 20 percent. In the same period 41 percent of the payroll was identified as being distributed to aerospace production employees. According to AIA estimates [Ref. 22] production workers accounted for 49 percent of total aerospace employment during this period.

Hourly earnings of production workers were compared for several industries, with the conclusion that aerospace is a relatively high-paying industry. Further, it was found that wages in the aircraft segment (SIC 3721) were growing at a rate substantially greater than the other aerospace segments and greater than all other industries. It was also suggested that this growth parallels continued growth in

TABLE XXII

Private Nonfarm Workers
Employment Cost Index (ECI)
Total Compensation

June 1981 = 100

	12/80	12/81	% Change	12/82	% Change
Occupation:					
White-Collar	94.5	104.0	10.1	110.8	6.5
Blue-Collar	94.9	104.0	9.6	110.3	6.1
Services	94.8	103.1	8.8	111.8	8.4
Industry:					
Manufacturing	94.7	104.0	9.8	110.4	6.2
Nonmanufacturing	94.7	103.9	9.7	110.8	6.6

Wages & Salaries
July 1981 = 100

Occupation:					
White-Collar	95.2	103.9	9.1	110.6	6.4
Blue-Collar	95.7	103.9	8.6	109.7	5.6
Services	94.8	102.7	8.3	111.4	8.5
Industry:					
Manufacturing	95.7	104.0	8.7	109.8	5.6
Nonmanufacturing	95.2	103.8	9.0	110.5	6.5

Source: Monthly Labor Review [Ref. 22].

the share of DOD aerospace expenditures that this sector enjoys. Supplements to wages and salaries were investigated, with the conclusion that supplements in all of the aerospace segments, if slightly below, mirrored manufacturing in general. From the data presented it can be inferred that industry specific compensation statistics were generally unavailable for this survey of published statistics. There are a number of published general trend indicators that are useful in making comparisons, but the highly aggregated nature of these statistics presumes that first any specific industry data be obtained from another source.

IV. PAY FACTORS

A. OVERVIEW

The purpose of this section is to explore some of the theoretical determinants of pay. The Bureau of Labor Statistics, in addition to programs already discussed, conducts four occupational wage surveys geared to collecting earnings information. They are the industry wage survey; area wage survey; national survey of professional, administration, technical and clerical pay (PATC); and government wage survey. In 1979 the BLS printed a compendium of factors that previous surveys seemed to indicate influence pay primarily in domestic manufacturing. The study, Profiles of Occupational Pay: A Chartbook [Ref. 27], separated BLS findings into three categories, (1) an overview of occupational pay, (2) profiles of high- and low-paying metropolitan areas and (3) profiles of high- and low-paying manufacturing industries. This section will be organized along similar lines as the factors and conclusions are enumerated and, where possible, parallels drawn to the aerospace industry. All references to the information cited are credited to the aforementioned study unless otherwise noted. The BLS commented that its data are

> ...used extensively in the private sector in connection with wage and salary determination by employers or in the collective bargaining process. To the extent that wages are a factor, survey data also are considered by employers in locating new facilities and in estimating costs [Ref. 28].

The same reference also carried the following statement repeating to some degree previously-discussed warnings to exercise caution:

> Occupational wage surveys are not designed to supply mechanical answers to questions of pay policy. The applicability of survey results depends upon the selection and definition of industries, the geographic units for which estimates are developed, the occupations and associated items studied, and the reference data of particular surveys [Ref. 29].

B. OCCUPATIONAL PAY

1. Occupational Distribution

The BLS divides workers into the four classifications, white-collar, blue-collar, service and farm. In 1978 white-collar workers were 50 percent of all employed persons, blue-collar 33.4 percent, service 13.6 percent and farm 3 percent [Ref. 30]. It is helpful to note that a review of BLS literature allows for the following interchangeability of terms in order to make general comparisons: white-collar/office worker/non-production employee and blue-collar/non-office worker/production worker/related worker in a non-manufacturing industry. From Tables VI and VII it can be seen that in the same period white-collar employees constituted 28.7 percent of all manufacturing employees and 53.6 percent of all employees in the aircraft (SIC 3721) segment. In 1982 the ratios were 32.2 and 54.8 percent respectively.

In a recent labor article, U. S. News and World Report [Ref. 31] reported that since 1947 the actual number of

production workers in manufacturing held steady, while the number of non-production workers more than doubled. The article offered various rationales for this phenomenon. Explanations included the proliferation of middle-management during good times and the tendency not to lay off this staff during down-cycles and labor-saving production processes. The substance of the article was that the office staff is the subject of intense cost trimming effort by many industries today.

2. Components of Compensation

In 1977 pay for time worked constituted about 75.8 percent of total compensation for white-collar employees and 77.5 percent for blue-collar. The figures are compatible with those in Table XVII, when pay for vacation and other time not worked is also considered. The data were apparently derived from the same discontinued series [Ref. 32].

3. Occupational Group Earnings

There are wide differences in pay levels among the four occupational groups. In May of 1978 the median earnings of blue-collar workers were about average for all groups. Median earnings for most white-collar groups were above average and earnings for service and farm workers, well below. Within groups there were wide differences in earnings. In the white-collar group earnings of professional and technical workers were two-thirds higher than clerical workers.

4. Occupation Earnings

In white-collar occupations, median salaries for workers in the highest and entry level positions differ by a factor of about three. Data were presented for chemists and engineers in private industry in March 1978 [Ref. 33]. They showed that the relative pay advantage that existed at lower levels shifted at the top of the scale. At the entry level, engineers enjoyed a $171 pay advantage, while at the highest level chemists enjoyed a $409 advantage. In blue-collar occupations (maintenance craft workers) the median earnings among occupations tended to be less dispersed. The rationale given was that these workers tended to be concentrated in large firms, where labor agreements tended to set wage levels among these workers at a single journeyman rate.

5. Skilled vs. Unskilled

On the basis of a study of union rates for journeymen relative to laborers in the construction industry, the BLS concluded [Ref. 34] that the advantage which skilled workers had earlier (1912 = 200 percent, approximately) had stabilized by the mid 1960's at 30 percent. Minimum wage increases and the homogenizing effect of labor agreements keying on the journeyman standard would most likely explain most of this effect. There is no reason to suggest that the improvement in the laborer's position came at the expense of the skilled worker.

6. Industry Pay Ranges

The report concluded that "the industry in which a job is located may be a more important influence on pay than the occupation itself" [Ref. 35]. The data compared production (and related) workers in high- and low-paying industries. The BLS found that, although unskilled jobs ranked lowest on the pay scale, unskilled occupations in one industry could actually earn more than skilled workers in another. The example cited was that of janitors in petroleum refining, who earned more on the average than the most skilled workers in the men's suit industry. The time of reference was a six-month period in 1976. The study also stated that earnings in the same job may vary considerably due to length of service and differences in pay scales among establishments.

7. Location

The BLS concluded that location was an important factor in pay levels for workers studied in 1976. For skilled production and white-collar workers, pay was generally 120 percent of the all-metropolitan-area average in high-paying metropolitan areas. Pay in low-paying areas was generally 80 percent of average. The difference between areas was more pronounced for unskilled production workers; in high-paying areas pay was 140 percent of the all-area average. In low-paying areas it was about 65 percent of average.

C. METROPOLITAN AREA EFFECTS

The area factors cited by the BLS were drawn from its 1976 annual wage survey program covering 70 metropolitan areas [Ref. 36]. Office workers were contrasted with maintenance and unskilled plant workers. This was a basic white-collar versus blue-collar division, with skilled and unskilled workers in each group. High-paying areas[5] were predominantly in the North Central and West. Low-paying areas were typically in the South; however, Atlanta and Washington were typically high-paying areas for office workers.

1. Labor Market Size

Half of the high-paying areas constituted large labor markets (500,000 or more). There were no high-paying areas with a small labor market (under 100,000). Four-fifths of the low-paying areas were concentrated in medium size labor markets.

2. Establishment Size

The BLS does not conclude positively that large establishments necessarily have an association with high pay levels. However, in areas designated as high-paying for office workers, these workers were equally divided between large (280 employees plus) and medium sized establishments. In about one-third

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[5]Of the 70 areas studied, 26 were classified as high-paying and 15 as low-paying. Forty percent then remained classified as average.

of the areas designated as high-paying for plant workers, these workers were concentrated in large establishments. In about half of the areas designated as low-paying for all employees, the workers were in establishments classified as small (under 190) or medium.

3. Unionization

The BLS found that workers in high-paying areas were more unionized. This was true for both office and plant workers, although plant workers were more unionized. The conclusion was drawn that unionization tended to raise pay levels. A BLS report on union negotiations in the aerospace industry [Ref. 37] commented on cooperation between the two major unions in the aerospace industry, the International Association of Machinists and Aerospace Workers (IAM-AFL-CIO) and the United Automobile, Aerospace and Agricultural Workers of America (UAW-Ind.). Cooperation ranged from early jurisdictional rivalry to intermittent joint bargaining conferences.

> In 1980, as in 1977, the unions scheduled separate conferences to shape bargaining goals, while coordinating objectives and strategies informally...an early settlement at a major company usually sets a pattern [Ref. 38].

In commenting on current (1980) negotiations the report on collective bargaining stated:

> The main goal declared at the UAW 1979 aerospace conference and expected to be repeated at the 1980 conference... was achievement of settlements similar to those in the auto industry [Ref. 39].

4. Influence of Manufacturing Activity

The conclusion was drawn that the presence or absence

of manufacturing activity in general did not cause an area to be classified as high-paying. Only one-third of the high-paying areas for plant workers were characterized by high manufacturing activity (60 percent or more). Manufacturing activity was less significant for office workers. What was significant was the presence of high- or low-paying industries. It is the mix of industry that bears most on area classification.

D. INDUSTRY PROFILES

These data were taken from the BLS's industry wage survey program. The aerospace industry is not a part of that program. Hourly earnings for blue-collar workers in 40 manufacturing industries were compared to the all-manufacturing average in 1977. At least a 10 percent difference was needed to classify an industry as high- or low-paying. Fourteen industries were classified above the line and 18 below. From tables XI and XIII it can be seen that all of the aerospace segments can be classified as high-paying under this criterion.

1. Capital Intensity

The book value of an industry's plant, property and equipment (PPE) per production worker was used as a measure of capital intensity. A standard of $15,000-$45,000 per worker was used. 57 percent of the high-paying industries met this criterion and 16 percent exceeded it. In contrast, 38 percent of the low-paying industries met the criterion, and all others were below. The same criterion can be applied

to the aerospace industry in 1977. Table VII estimates the number of employees in SIC codes 372 and 376 (Aircraft and parts; guided missiles, space vehicles and parts) at 273,200. Data from the AIA attributed to the FTC show net PPE for the same SIC codes amounted to $4.32 billion in 1977 [Ref. 40]. An amount of $15,813 per production worker can be derived. Since this amount barely meets the criterion, aerospace cannot be classified as high-paying based on capital intensity, even though the industry is traditionally characterized as such.

2. Shipment Concentration

Concentration in a few large firms was more common in high-paying industries. The BLS defined a concentrated industry as one in which four firms accounted for half or more of the value of shipments. Only five of the industries studied met this criterion, but four of the five were classified as high-paying. According to the Bureau of the Census [Ref. 41], in 1977 shipments in the aircraft industry (SIC 3721) were 59 percent for the top four firms (down from 66 percent in 1972) and 81 percent for the top eight (down from 86 percent in 1972). In guided missiles and space vehicles (SIC 3761) shipments for the top four firms were 64 percent (up from 62 percent in 1972), and the top eight accounted for 94 percent (up from 85 percent). The aerospace industry meets this test of a concentrated industry.

3. Other Factors

In half of the high-paying industries plants were classified as large. Only one low-paying industry met this criterion. While 93 percent of the high-paying industries were 75 percent unionized, only 11 percent of the low-paying industries were as heavily organized. Most of the high-paying industries were located in metropolitan areas, low-paying industries were concentrated in the South and smaller areas. Interestingly, the BLS found that incentive pay systems were predominant only in low-paying industries. Incentive pay plan workers earned more than their wage and salary counterparts. The spread of earnings within a particular occupation was more narrow in high-paying industries. As a point of interest, this report [Ref. 42] noted that no high-paying industries had even 5 percent of their workers near the minimum wage level. One-third of the low-paying industries had employees within 10 percent of the minimum wage.

E. LABOR ELASTICITY

The elasticity of the labor supply was not addressed by the BLS as a factor in a high- or low-paying industry classification. However, the relationship between employment and sales in the aircraft industry has been explored in detail. S. L. Carroll, writing in 1970 on the elasticity of the labor supply in the airframe (aircraft) industry, noted

> It has been observed that airframe companies tend to hoard resources, particularly skilled laborers, technicians, and engineers not needed for current projects. More precisely, it has been hypothesized that employment in the industry adjusts very slowly to changes in demand; that is, that the industry has a lower labor elasticity with respect to sales than do other industries [Ref. 43].

Carroll summarized a test by F. D. Arditti and M. J. Peck, in which the hypothesis that cost-based pricing allowed firms to retain their skilled workers, was tested [Ref. 44]. The test involved regressing the logs of total salaries for eight industries during the period of 1957-1962 over the logs of sales and some labor variables. Only the labor elasticity coefficient was found to be significant between industries. The aircraft elasticity was the lowest. "...the conclusion is reached that labor elasticity is lower in the aircraft industry than in the others studied due to cost-based pricing" [ref. 43]. The term cost-based pricing as used in the Arditti and Peck study is presumed to refer to common government practice of agreeing to pay all reasonable costs involved in production plus a profit to the manufacturer.

F. SUMMARY

The information presented by the BLS in its report of occupational pay covers a broad spectrum of factors that influence pay in manufacturing industries. The data presented by the BLS supporting the classification of metropolitan areas as high- or low-paying are not entirely clear on establishing some causal relationships. (E.g. Is an

industry high-paying because it is located in a high-paying area, or, does an area's classification, as the information suggests, depend on the presence of high-paying industries?) The fact, however, remains that three independent variables (occupation, area and industry) are involved in the wage equation. These variables will be mentioned again in the next chapter in connection with Dunlop's work.

V. THEORETICAL CONCEPTS OF WAGES

A. GENERAL WAGE THEORIES

In this chapter some general theories and concepts of wages will be presented. These concepts comprise a significant portion of general labor theory, offer insight into the occupational and industry characteristics discussed in the previous section, and contribute to an understanding of some of the topics discussed in earlier chapters. The purpose is to provide a context in which the observations that have been made may be more fully understood.

W. K. Liang in Toward an Institutional Theory of Wage [Ref. 45] discussed a number of general wage theories. These sections draw heavily from his work. His discussion was prefaced by noting the effects that the industrial revolution brought to bear on the existing apprentice-master relationship that predominated. He noted that, prior to the advent of machinery and mass production techniques, the worker's wage was composed of twc parts, (1) payment for a basic level of workmanship of the job and (2) the personal touch of the craftsman that was judged and compensated for as the master saw fit. The industrial revolution brought standardization in that each worker was able now to turn out exactly the same product. Standardization was thus firmly established and the product differentiation (personal touch) that had

been the hallmark of the individual craftsman was lost, as well as this component of compensation. Since product differentiation was lost, it followed that workers on similar jobs should be paid equal wages for their equal work.

1. Subsistence Theory of Wage

Liang viewed the subsistence theory in the classical economic concept that labor is a commodity that could be bought and sold. Its exchange value is determined by the cost of its production. Thus the price of labor, according to the classicists, is that required in producing or recharging the labor power [Ref. 46]. Liang attributed the development of the subsistence theory to David Ricardo's ideas on the natural price of labor. They centered on Ricardo's definition of this natural price as the price necessary for the laborer to subsist and perpetuate his race.

> The natural price of labor, therefore, depends on the price of food and necessaries, and conveniences required for the support of the laborer and his family. With a rise in the price of food and necessaries, the natural price of labor will rise; with the fall in their price, the natural price of labor will fall [Ref. 46].

The classicists recognized the influence of supply and demand on the price of labor. A market price above the laborer's natural value would encourage an increase in population and the increase in population would cause the wage to fall.

2. The Wage Fund Theory

Liang attributed the original version of the wage fund theory to Adam Smith. He envisioned a fund for the

payment of wages originating from the surplus income of employers that was available after their immediate needs were satisfied. This fund was used to employ laborers in the production of goods. A more precise definition was attributed to John Mill:

> Wages, thus, depend mainly upon the demand and supply of labor; or as it is often expressed, on the proportion between population and capital. By population is here meant the number of the laboring class only, or rather those who work for hire, and the capital only circulating capital and not even the whole of that, but the part which is expended in the direct purchase of labor [Ref. 47].

Thus if the supply of laborers is constant, wages cannot rise unless there is an increase in the amount of capital available for payment. Liang notes that it is not the absolute amount of capital that is of importance to the laborers but, rather the percentage available to them as a group.

3. Marginal Productivity of Labor

Based on the laws of diminishing returns and profit maximization in a capitalist society, the theory of the marginal productivity of labor states that laborers will continue to be hired until their wages equal the marginal products of their labor. Any increase in the labor force beyond this point will cause the employer to lose money and thus, profit would not be maximized. Liang noted that, in today's complex manufacturing industries, there exists no method for measuring the marginal product accurately. He further discussed the inadequacy of the marginal product theory, in that it is

a one-sided demand theory of labor, in which the supply of labor is always taken as given.

4. Criticism of Existing Theories

Liang stated that the subsistence and marginal product theories were essentially "two sides of the same coin" [ref. 48]. The former explained the supply side and the latter, the demand of labor. Both theories were deemed inadequate to explain completely the action of wages in a modern society influenced by collective bargaining, in that they were based on the premise that labor should be paid only a minimum wage. The wage fund theory attempted to look at both supply and demand but applied only to the economy as a whole and thus failed to distinguish between labor markets and individual industries.

Liang concluded that these theories ignored the human value of labor by treating labor as a commodity. The concept of labor as a commodity was considered obsolete, and in his work, Toward an Institutional Theory of Wage, he went on to develop an institutional theory of wage, based heavily on the influence of collective bargaining in the wage setting process. In so doing, he developed a set of major wage determining concepts which explain the current wage structure. These are discussed below.

B. WAGE DETERMINATION CONCEPTS

Liang saw the wage formula as wage earnings equal to money wage plus wage supplements and fringe benefits [Ref. 49].

The money wage was pay for the job performed or the productivity of the labor and could be objectively measured. The supplements and fringe benefits were recognition of the human value of the job and, by definition, subjective in nature and difficult to measure. These concepts, as explained by Liang, will be described below.

1. Money Wage

This is the pay for work performed, the workers contribution to production. The concept behind this wage is one of the productivity wage, analagous to the marginal product of labor [Ref. 50]. It follows that workers should be paid an equal wage for equal work. Along with the productivity concept is the concept of payment for the worker's rights on the job. This latter concept is behind compensation for items other than productivity which are included in the money wage. Such items are overtime premium, incentive bonus, shift differentials, and lunch and wash-up time. The two parts of the money wage correspond to the payroll term used in previous chapters.

2. Wage Supplements

These are the legally required payments that the employer must make on behalf of the employee. Unemployment insurance and workmen's compensation payments are supported by a maintenance wage concept. The maintenance wage concept invokes an idea of morality in that the employer must expect to pay the full price of labor throughout the period in which

he has it available. This applies even when, through no fault of his own, the laborer is not able to work [Ref. 51]. This is a form of insurance that the employer pays to have labor at his disposal and that guarantees the laborer a steady and certain income.

3. Fringe Benefits

Health care and hospitalization insurance, vacation pay and life insurance are fringes paid by the employer under a concept entitled overhead wage. Payments for social security and pension funds are covered by a depreciation reserve concept. The overhead wage concept simply recognizes that these payments by the firm are necessary in order to preserve the welfare and morale of the worker. They are, in fact, operating expenses incurred in the employment of labor. The depreciation reserve concept is based on the premise that payments to pension plans are, in fact, deferred wages designed to sustain workers after they have stopped working. This is in contrast to the maintenance and overhead concepts designed to sustain workers while on the job [Ref. 52]. Liang also enumerated a number of other concepts for types of pay commonly classified as fringe benefits: liberty wage (call-in-pay), citizenship wage (pay for jury duty), civil right wage (pay for voting time), and good-will wage (severance pay and profit sharing).

C. JOB CLUSTERS AND WAGE CONTOURS

John T. Dunlop in writing on The Task of Contemporary Wage Theory [Ref. 53] in 1957 had many of the same reservations about the applicability of classical labor theory to the modern industrialized world as Liang did in 1974.

> Wage theory must operate with the concept of wage structure--the complex of rates within firms differentiated by occupation and employee and the complex of interfirm rate structures [Ref. 54].

The key concepts that Dunlop felt applied to any analysis of the wage structure were those of job clusters and wage contours.

1. Job Clusters

The job cluster is a stable group of job classifications within a firm. The wage rates for the jobs within a cluster are linked by the forces that cause them to move. The wage rates for jobs within a cluster are not necessarily identical, but the movement of those wages is triggered by the same wage setting mechanisms. Promotion and layoff patterns may be similar. Thus, the overall wage structure of a particular firm consists of a number of these clusters. The job cluster would contain a key rate or group of rates. The key jobs would exhibit stable job content and standardization among firms.

> The key rates are those which managements and unions typically have in mind and explicitly discuss in considering the internal wage structure [Ref. 55].

Dunlop notes that forces which act on these key rates are not confined to the firm but are affected by the exterior and spread from one cluster to another. The exterior consists of the influences of the labor market, government and union wage policies, and forces in the market affecting products [Ref. 56].

2. Wage Contours

Dunlop defines wage contours as follows:

> A wage contour is...a stable group of wage-determining units (bargaining units, plants or firms) which are so linked together by (1) similarity of product markets, (2) resort to similar sources for a labor force, or (3) common labor-market organization (custom) that they have common wage-making characteristics [Ref. 57].

A contour for a particular occupation then

> ...has three dimensions: (1) particular occupations or job clusters, (2) a sector of industry, and (3) a geographical location [Ref. 58].

The author noted that the contours did not have well-defined boundaries and that in some localities the influence of particular firms or collective bargaining units could cause firms to be included in one contour where they normally would be included in another. Also, the expansion of firms or unions into other product markets may change existing clusters and contours. As mentioned above, it is through the key rates in the job clusters that these external forces are transmitted cluster by cluster throughout the firm. Dunlop concludes that it is the differences in the product market that are reflected back into the labor market [Ref. 59].

He observed that, when the labor market was tight, the various contours bid competitively for labor and thus establish separate wage structures. Over time these structures became customary and showed resistance to change in a looser labor market. Newer and expanding industries have had to pay more to attract a labor supply and, because the demand for their products was high, could afford to do so. Although recognizing that a wage structure is influenced by a number of factors such as job content and methods of compensation, Dunlop was clear in stating, at least in the short run, that it was the competitive position of the product markets that affected the wage structure. In the long-run the wage structure was more affected by the rate of industrialization. In a larger sense, this is still the same concept of new industries creating skill differentials which are reflected in the wage structure.

D. SUMMARY

The concepts presented in this chapter, though theoretical in nature, are practically applied, if only in a circuitous manner, by a number of agencies concerned with the collection of labor and related statistics. As discussed in Chapter III, the BLS series on hourly wage rates for production workers shows continued heavy emphasis on the "laborer" so often referred to in classical labor theory. The use by the BLS of capital intensity (Chapter IV) to classify an industry as high- or low-paying draws heavily on the wage fund theory.

The concept of key rates within job clusters supports the BLS' use of a few occupations to draw conclusions about entire divisions of labor, such as white- and blue-collar workers. If specific occupational wage data (in addition to the limited data previously discussed) were available for the aerospace industry, then the concepts of job clusters and wage contours would prove a most useful construct with which to approach an understanding of the complete wage structure of the industry.

VI. CONCLUSION

Any analysis of this type is greatly influenced by the classification system used in the formulation of the data sources in the analysis. BLS statistics on hourly wages of production workers provide the degree of specificity necessary to make comparisons by industry. According to these statistics, the aerospace industry would rank among the top two industries in terms of average hourly earnings. Further, it was established that the aircraft segment is in a position of dominance in the industry and continues to enjoy a rate of increase in production worker earnings higher than the remaining aerospace segments and all other industries considered. According to one criterion employed by the Bureau of Labor Statistics, the existing level of production worker wages in the aerospace industry is sufficient to earn the industry a classification as high-paying.

In terms of determining the nature and composition of the wage structure in the industry and for a particular sector (e.g. aircraft), an analysis of the movement of wages within firms should prove fruitful. The data presented in this analysis showed that payroll in the aerospace industry amounted to 52 percent of sales in a period when the average for all manufacturing was about 20 percent. Further, within the industry about 41 percent of this payroll was distributed

to the production employees, the group selected for analysis in this thesis. There remains to be considered the group classified as non-production, which constitutes about 51 percent of aerospace employment. Industry specific data for these white-collar occupations is generally not available in government statistics, as only a limited number of industries are covered by the BLS's industry wage survey program. Occupational data are available through a number of programs, but the data appear to be oriented towards metropolitan areas and are not industry specific.

The question then remains if the occupations used by the BLS in its sampling process are representative of the mix of occupations that determine the internal wage structures of aerospace firms. The high level of wages among aerospace production workers and the aircraft sector in particular indicates that further investigation is certainly warranted. The identification of job clusters and the key jobs within these clusters seems to be an appropriate initial direction for continued investigation.

The wage contour, as explained by Dunlop, must then be fully developed and the forces which influence the general level of wages in the industry understood. Once the level of compensation and the factors which influence changes in that level are identified, we may address the question whether that pay structure is appropriate for pricing government contracts. Dunlop's emphasis on product-market differentiation

as a prime determinant in wage structure might lead one to conclude that the aircraft sector's propensity to increase wages at a rate higher than the rest of the aerospace industry is merely symptomatic of its clear majority share of DOD expenditures in aerospace.

What would one infer from such a conclusion? Dunlop stated that it is the emergence of new industries (product demand and profitability are presumed) and their competition for existing skills and demand for newer ones that, in the long-term, most influence the wage structure. A full understanding of compensation in the aerospace industry depends upon a detailed analysis of the industry wage structure and the internal and external factors that influence it. Government action in this matter could then be predicated on such an analysis.

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